Data Fusion Requirements Document

<u>Introduction</u>

This document was created by the Data Fusion Requirements Team, sub-team created by the CLCS Application Software Team.   The intended use of this document is to provide the data fusion developers with Application software needs and inputs.

<u>Major Sections</u>

- Data Fusion Manager Requirements
- Data Fusion Editor Requirements
- Data Fusion Viewer Requirements

Data Fusion Manager Requirements

<u>Calculations/Formula/Logic</u>

Arithmetic Operators (addition, subtraction, multiplication, division, modulus)
Relational Operators (less than, greater than, less than or equal to, greater than or equal to, equivalent, not equivalent)
Logical Operators (AND, OR, XOR, NOT)
  Note: Logical operators shall be available inside or outside the calculations.
Bitwise Operators (AND, OR, XOR, left shift, right shift, ones complement, twos complement)
Conditional Operators (if then else logic inside or outside of the equation/calculation)
Power Function   (a**b) and exp function (e**x)
Square Root Function
Conversion factors should be inherent/available (knots to miles/sec, degrees to radian, BCD to decimal, hours to minutes etc.)
Absolute Value, Log and Log10, pi
Trigonometric Operations (sin, cos, tan, cot, sec, csc, arctan)
Average
   - a given number of "samples/readings"
   - values a certain time frame apart (every 5 sec)
   - values over time (all readings over the last 20 sec)
   - median value
Minimum/Maximum function
   - Given floating point value of 1.5 : min returns 1 and max returns 2
   - Given a number of fds : min returns the lowest and max returns the highest
Time Based Operations
  - The ability to look at fds over time and produce a continuous output (example: over the last 26
      sec what is the % wet OR what is the average of the last 5 samples of temperature)

- Have time relationships associated with data fused fds.
- Trend analysis - Past performance and future predictions.
- Time conversions handled automatically (min. to sec. to hrs. etc.)
  Data fused fds will always be calculated - just like any other fd. There is
      no capability to start or stop the calculation, but an engineer may mark the
      data fused fd as invalid (by a bypass in data validity).
The manager shall properly support time homogeneous fds.
The manager shall conform to operator precedence consistent with the C language.
(Use of parenthesis overrides defaults).

Data Fusion Inputs

Inputs shall be any data available in the data stream. There shall be no limit to the number of fds used in a calculation.

Data Fusion Output

Data fusion fds shall be available to all consoles and the CCP. Output can be any type (the user will determine output type upon creation). This includes any type of current fd type and new types (Enumerated data types/structures).

Several options shall be available for controlling when data fused fds are calculated.

1. Default - Calculated all the time. In this case, data fusion fds shall be calculated real-time regardless of the data rates of the incoming data. Calculations are made as needed.
2. User/Operator option to "slow down"/control when data fusion is calculated based on time (every 5 seconds) or samples (if there is such a thing - every 5 samples).

Permissions

Every ASWT can create data fused fds from any fd, regardless of ownership. Each ASWT/ODIS shall be responsible for the data fused fds they create. This includes creation, modification, deletion and approval.

User Interfaces

The user cannot change the output data (excluding values of user-changeable variables) of a data fused fd (either from the command line, the software or any other way) however debug options should be available (example is to FAIL the data fused fd to a given value in a software debug environment).

Data fused fds shall be treated the same as current fds. There can be limit setting (for interrupts) and the standard rules for RSYS/ODIS/RCL etc. apply.

The calculations/formulas may have user-changeable variables. The user can alter these values real-time as needed to change the data fusion calculation but not the formula. There shall be either a default value specified in the editor for all user-changeable variables or the data fused fd shall be marked as invalid until the user-changeable variable is initialized. There shall be a way to change the value of a user-changeable variable from application software in the console and in the CCP.

Naming Conventions

Data Fused fds shall be distinguishable from a regular fd.

Data Validity

The data validity of a data fused fd shall be determined in real-time. Only the validity of fds used in the logic path / real-time calculation shall be combined (logically OR'd) to determine the data validity of the data fused fd.

The same data validity options/information available for a normal fd shall be available for a data fused fd (Engineer bypass etc.).

Data Fusion Editor Requirements

The user shall have the following functions available from the editor:

- The ability to add, modify or delete a data fused fd under their respective discipline/ownership
- The ability to view and search other data fused fds and their compositions to help create/edit. The search capability can offer filtering options. The user can input one fd or a group of fds and the editor shall display all data fused fds containing those items. The user can select a system or ODIS and the editor shall display all system data fused fds. The user can browse through a data bank and select fds.
- The ability to test their calculation (debug it) prior to submitting it. The editor shall warn the user if inconsistent data types are used (for example adding a pressure measurement and a temperature measurement). The user can override the system and state the output type.
- The ability to select available options with an easy to use tool (maybe GUI interface)
- The ability to view a help feature
- The ability to enter comments (to help explain the formula etc.)
- The ability to state the output type (units)
- The ability to copy, cut and paste

In addition, the editor shall support the following:

- Alert the user if an entered data fused fd already exists (a similar formula etc.)
- All fields found in a normal fd (depending on type)

- Not be available real-time (the user must use the viewer), data fused fds cannot be created in a real-time environment. They must be edited/created prior to TCID build (variable setting is an exception).
- Multiple lines

Intermediate variables shall be typed implicitly.

Data Fusion Viewer Requirements

The viewer is a subset of the editor. All information available in the editor shall be displayed.
In addition the following shall be displayed by the viewer:

- the current value
- the calculated formula and decomposition
- the current value of any variables and fds
- the data validity of the data fused fd should be easily seen (not just white data or stars and the data should be viewable on a hardcopy)
- responsible system of the data fused fd
- all comment fields

The viewer shall also support a help function.

Data Fusion Concerns

The data fusion manager may be used to implement the end item states used in the EIM. It may also be used in application software and display programs. Performance of the data fusion manager, however, could be directly related to the number of calculations. Depending on the utilization, the EIM state calculations could cause performance problems.

What type of data fused fds will be available for data fusion? Our input section states that only fds available in the data stream can be used. We have a concern over using other fds/data like LDB measurements.